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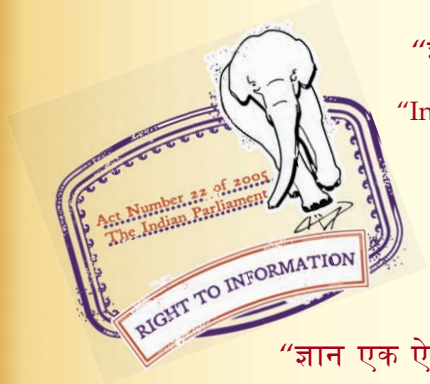
IS 11790 (1986): Specification for Code of practice for preparation of butt-welding ends for pipes, valves flanges and fittings [MED 17: Chemical Engineering Plants and Related Equipment]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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UDC 621·791·052·4 : 621·643·4

Indian Standard

(Reaffirmed 2003)

CODE OF PRACTICE FOR PREPARATION OF BUTT WELDING ENDS FOR PIPES, VALVES, FLANGES AND FITTINGS

Industrial Valves Sectional Committee, EDC 81 [Ref : Doc : EDC 81 (3868)]

1. Scope — Covers the preparation of butt welding ends of pipes, valves, welding neck flanges and pipe fittings. It is also applicable to other piping components which are connected to piping system by butt welding.

1.1 Materials for piping components for which these welding ends are primarily intended are carbon and alloy steels. They may also be used for nonferrous materials, upon satisfactory qualifications of welding procedures for the particular material.

1.2 The standard includes requirement for re-entrant shapes for heavy wall ends, welding bevel profiles, inside contours, for joints made with or without backing rings and internal and machining dimensions with their tolerances. The preparation of backing rings, if any, must be specified in ordering material to this specification.

1.3 This standard covers welding end preparation for four general types of joints but does not prescribe specific types of welding processes nor procedures. The four types of joints are:

a) no backing ring,

b) split or noncontinuous backing ring,

c) solid or continuous backing ring, and

d) consumable insert ring.

1.4 This standard also covers welding end preparation for gas tunguston arc welding (GTAW) of the root pass.

2. Transition Contours — The maximum envelope in which the transition from welding bevel to the outer surface of the component and from the root face to the inner surface of the component must lie as shown in Fig 1. The exact contour within this envelope is the manufacturer's option providing it maintains the specified minimum wall thickness and it has no slopes steeper than those indicated for respective regions and includes the proper surface for backing rings, if specified (except as specified in Note 5 under Fig. 1).

3. Welding Bevel Design

3.1 *Welding Bevels for other than 'GTAW' Root Pass*

3.1.1 Components having nominal wall thicknesses of 3 mm and less may have ends cut square or slightly chamfered ends.

3.1.2 Components having nominal thickness over 3 to 22 mm inclusive shall have single angle bevels as shown in Fig. 2.

3.1.3 Components having nominal wall thickness greater than 22 mm shall have compound angle bevels as illustrated in Fig. 3.

3.2 *Welding Bevels for 'GTAW' Root Pass*

3.2.1 Components having nominal wall thickness 3 mm and less may have ends cut square or slightly chamfered.

3.2.2 Components having nominal wall thickness over 3 to 10 mm inclusive may have $37\frac{1}{2}° \pm 2\frac{1}{2}°$ bevels, or slightly concave bevels as shown in Fig. 4.

3.2.3 Components having nominal wall thickness over 10 to 25 mm inclusive shall have welding bevels as shown in Fig. 5.

3.2.4 Components having nominal wall thickness greater than 25 mm shall have welding bevels as shown in Fig. 6.

4. Machining — Any machining of the inside diameter at ends is related to the type welding joint intended as follows.

Adopted 8 August, 1986

Gr 4

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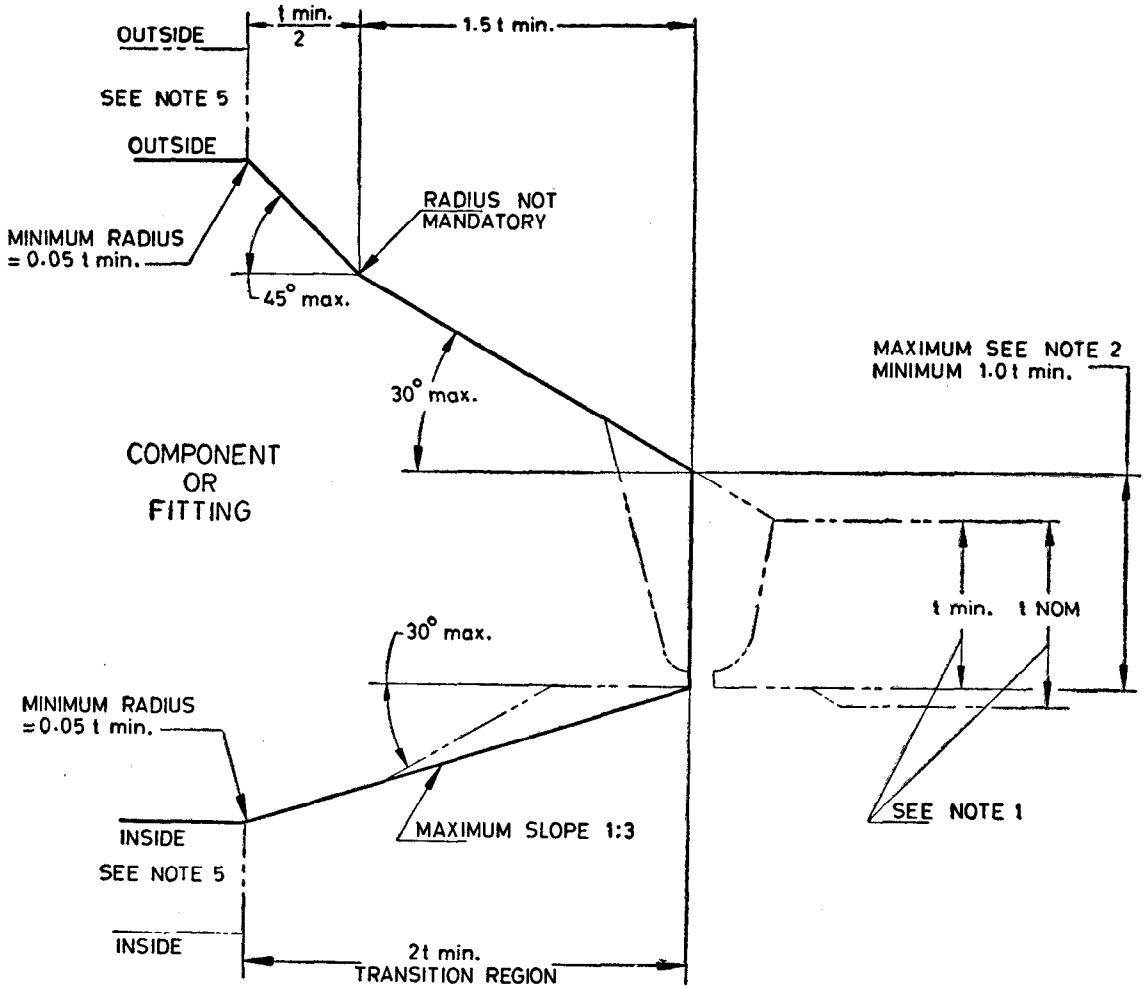


Note 1 — The value of *t* min is whichever of the following applicable:

a) The minimum ordered wall thickness of the pipe,

b) 0·875 times the nominal wall thickness of pipe ordered to a pipe schedule wall thickness with an under tolerance of 12·5 percent, and

c) The minimum ordered wall thickness of the cylindrical welding end of a components or fitting (or the thinner of the two) when the joint is between two components.

Note 2 — The maximum thickness at the end of the component is:

a) the greater of *t* min + 4 mm or 1·15 *t* min when ordered on a minimum wall basis.

b) the greater of *t* min + 4 mm or 1·10 *t* nom when ordered on a nominal wall basis.

Note 3 — Weld bevel is shown for illustration only.

Note 4 — The weld reinforcement permitted by applicable code may lie outside the maximum envelope.

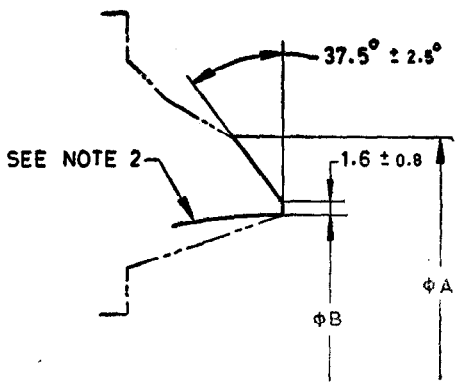
Note 5 — Where transitions using maximum slope do not intersect inside or outside surface as shown by phantom outlines maximum slopes shown or alternate radii shall be used.

FIG. 1 WELDING AND TRANSITIONS MAXIMUM ENVELOPE

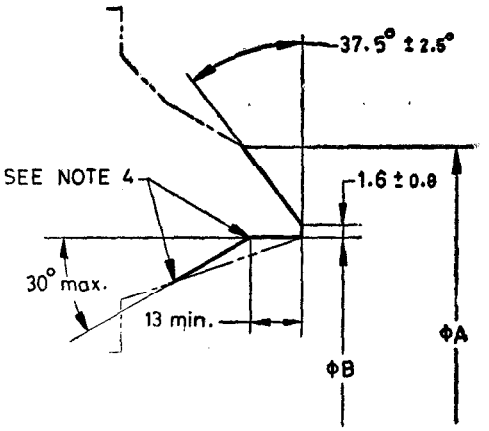
4.1 Components intended for welding without backing ring may be furnished as required in the relevant standard. Figures 2A and 3A illustrate a curved interior for example. Other contours within the envelope may be supplied to suit the component being furnished.

4.2 Components intended for welding using split or non-continuous backing ring may be furnished as required in the relevant component standard, providing the inner surface at the end is essentially cylindrical. Taper boring does not always satisfy this requirement when rectangular backing rings are to be used and the purchase order shall specifically make this distinction. Figures 2B and 3B illustrate a component counterbored to suit a split rectangular backing ring.

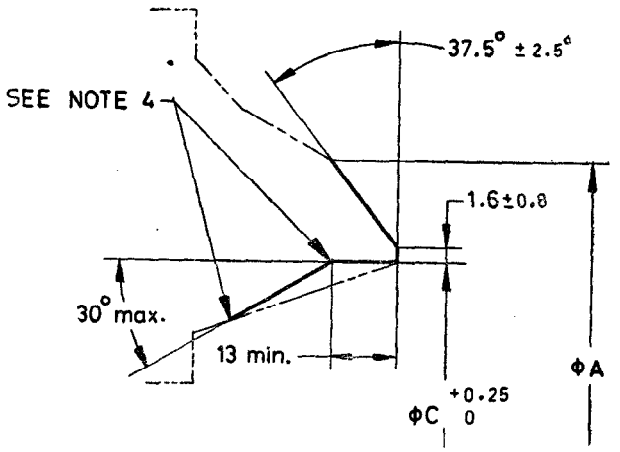
4.3 Components intended for use with solid or continuous backing rings require special manufacturing operations beyond those normally used in the manufacture of standard components. Figures 2C and 3C illustrate a component prepared for a continuous rectangular backing ring and Figures 2D and 3D illustrate a component prepared for a continuous tapered backing ring.



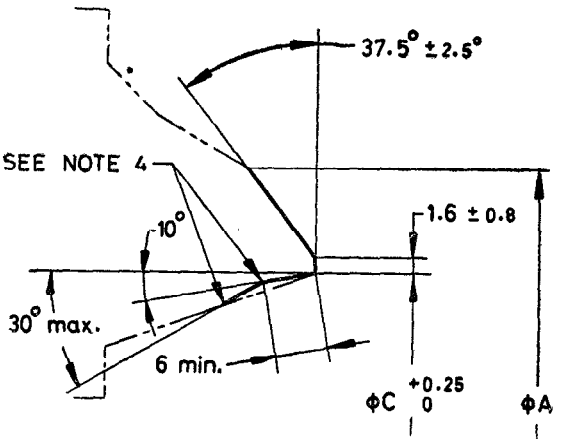
2A Welding end detail for joint without backing ring



2B Welding end detail for joint using split rectangular backing ring



2C Welding end detail for joint using continuous rectangular backing ring



2D Welding end details for joint using continuous tapered backing ring

Note 1 — Dotted lines denote maximum envelope for transitions from welding bevel and root face into body of component (*see* Fig. 1 for details).

Note 2 — Internal surface may be as formed or machined for dimension *B* at root face. Contour within the envelope is manufacturer's option unless otherwise specifically ordered.

Note 3 — *See* 5 for tolerances other than those given in these figures.

Note 4 — Intersections shall be slightly rounded.

Note 5 — Purchase order shall specify contour of ring intended to be used.

FIG. 2 WELDING END DETAILS INTENDED FOR USE ON 22 mm AND THINNER NOMINAL WALL THICKNESS

4.4 Components intended for use with consumable insert ring or 'GTAW' root pass; with or without consumable insert rings also require special manufacturing operations as indicated in Fig. 4, 5 and 6.

4.5 Dimension *C* shown in Fig. 2C, 2D, 3C, 3D, 5 and 6 are tabulated in Table 1 for 65 mm NPS to 600 mm NPS inclusive. The dimensions for other sizes and/or wall thickness may be determined by the following formula.

$$C = A - 0{\cdot}8 - 1{\cdot}75\,t - 0{\cdot}25$$

where

A = nominal outside diameter of pipe,

0·8 = minus tolerance on OD of pipe,

1·75 = minimum wall of 87½ percent of nominal wall multiplied by two to convert into terms of diameter,

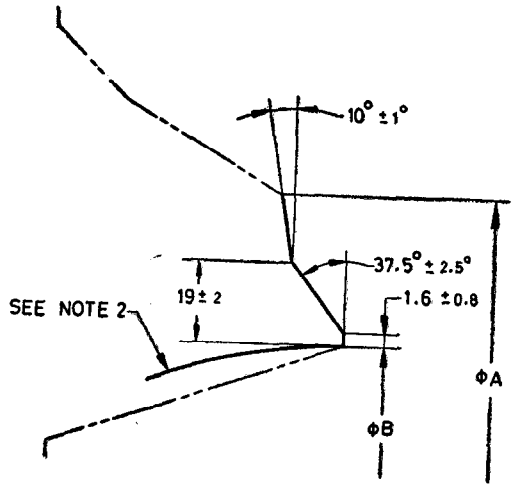
t = nominal wall thickness of pipe in mm, and

0·25 = plus machining tolerance on bore *C*.

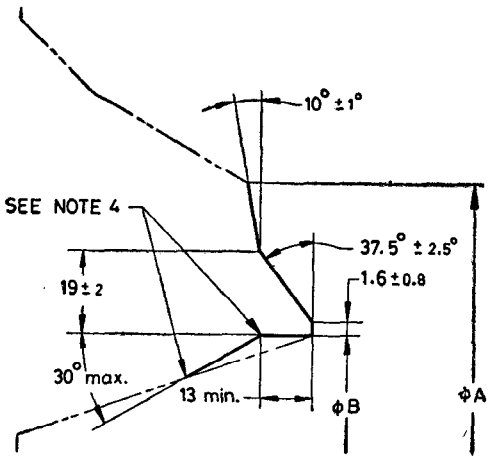
On the number of components in the smaller sizes and light duty it may be necessary to deposit weld metal on the inside diameter or use thicker wall material in order to machine for the backing ring and maintain required wall thickness. This condition may also arise when using material whose nominal dimensions indicate sufficient metal but whose actual ID considering tolerances may be large enough to require additional metal.

5. Tolerances — *See* Fig. 2, 3, 5 and 6.

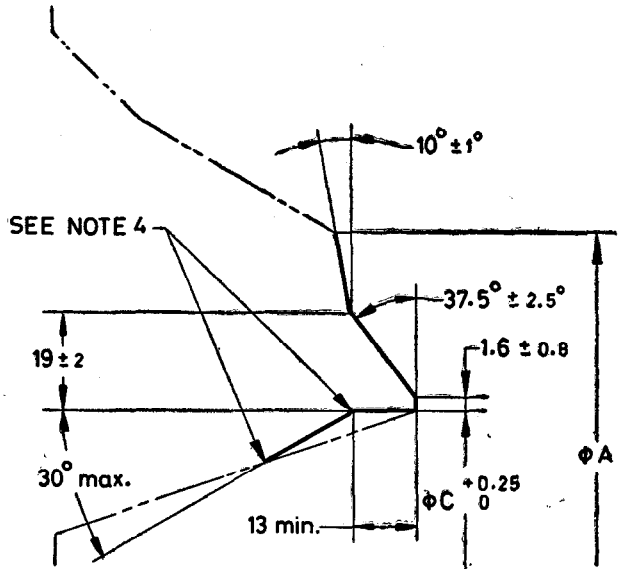
5.1 *Dimensions B* — Inside diameter at welding end (Fig. 2A, 2B, 3A and 3B).



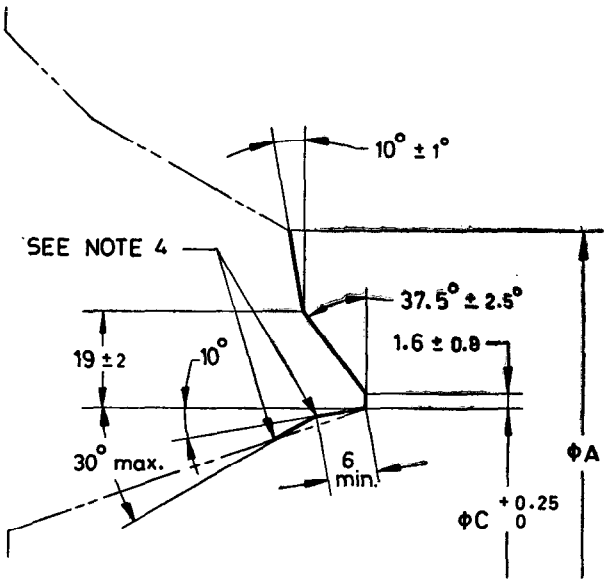
3A Welding end deatail for joint without backing ring



3B Welding end detail for joint using split rectangular backing ring



3C Welding end detail for joint using continuous rectangular backing ring



3D Welding end detail for joint using continuous tapered backing ring

Note 1 — Dotted lines denote maximum envelope for transitions from welding groove and root face into body of components (*see* Fig. 1 for details).

Note 2 — Internal surface may be as formed or machined for dimension *B* at root face. Contour within the envelope is manufacturer's option otherwise specifically ordered.

Note 3 — *See* 5 for tolerances other than those given in these figures.

Note 4 — Intersections shall be slightly rounded.

Note 5 — Purchase order shall specify contour of ring intended to be used.

FIG. 3 WELDING END DETAILS INTENDED FOR USE ON NOMINAL WALL THICKNESSES GREATER THAN 22 mm

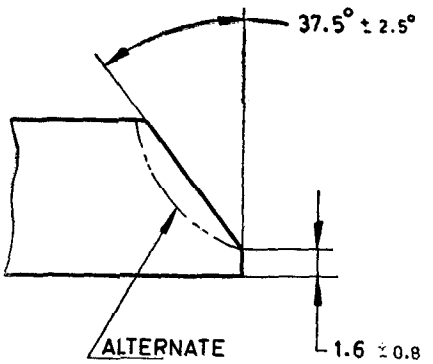
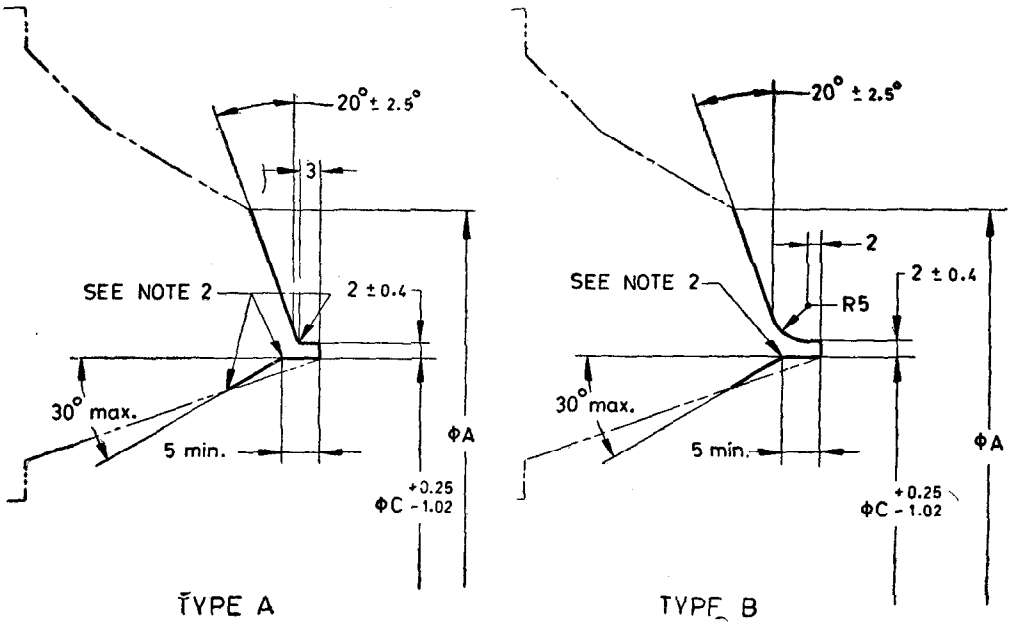


FIG. 4 WELD BEVEL DETAILS INTENDED FOR USE OF GAS TUNGSTEN ARC ROOT PASS WELDING OF NOMINAL WALL THICKNESSES OVER 3 mm TO 10 mm INCLUSIVE



Note 1 — Dotted lines denote maximum envelope for transitions from welding groove and land into body of component (*see* Fig. 1 for details).

Note 2 — Inside corners shall be slightly rounded.

Note 3 — *See* 5 for tolerances other than those given in these sketches.

FIG. 5 WELDING END DETAILS INTENDED FOR USE OF GAS TUNGSTEN ARC ROOT PASS WELDING OF NOMINAL WALL THICKNESSES OVER 10 mm TO 25 mm INCLUSIVE

5.1.1 *All components* — As specified in applicable relevant specifications for particular component.

a) For pipe — According to IS : 1978-1982 'Line pipe (*second revision*)'.

b) Valves and welding neck flanges—

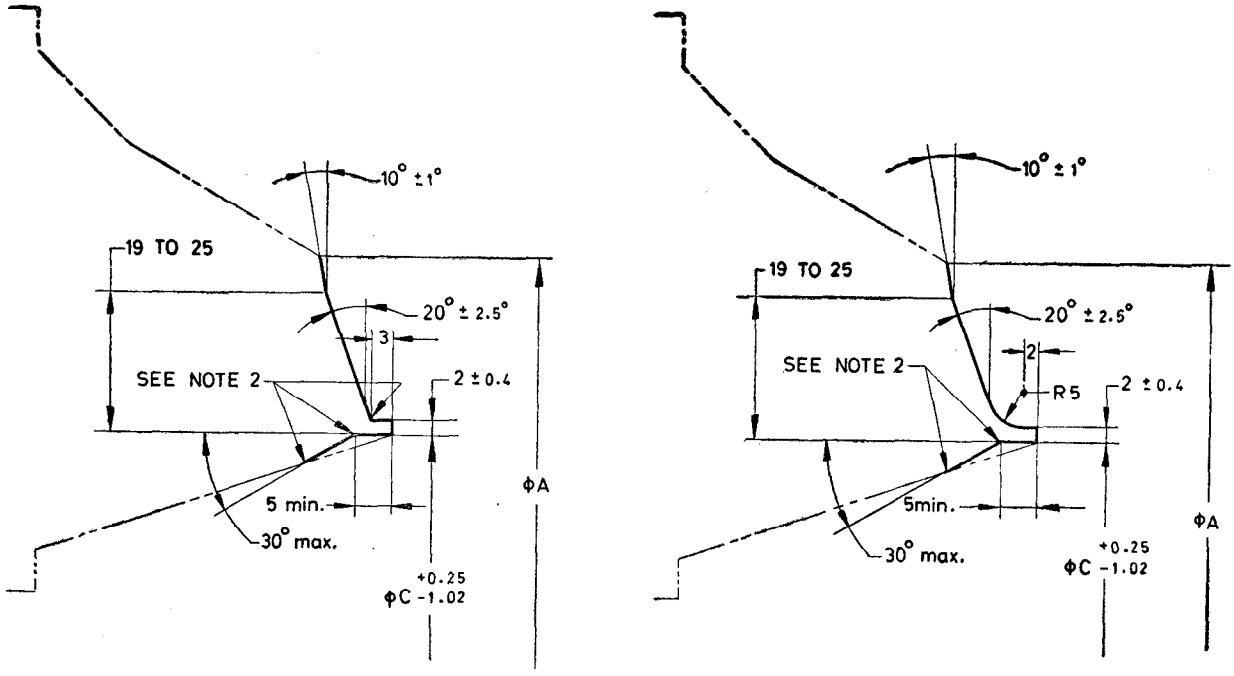
Without/with split backing ring		*With continuous taper or solid backing ring*	
250 mm and smaller	+ 0·8 — 0·8		+ 0·0 — 0·8
300 to 450 mm	± 1·6	300 and above	+ 0·0 — 1·6
500 mm and larger	+ 3·0 — 1·6		

c) Butt welding ends—without/or split backing rings

80 to 200	± 1·6
250 to 450	± 3·0
500 and above	± 4·8

5.2 *Welding Bevels, Root Face and Dimension C*

5.2.1 *All components* — As indicated in Fig. 2, 3, 4, 5 and 6.



Note 1 — Dotted lines denote maximum envelope for transitions from welding groove and land into body of component (*see* Fig. 1 for details).

Note 2 — Inside corners shall be slightly rounded.

Note 3 — *See* 5 for tolerances other than those given in these sketches.

FIG. 6 WELDING END DETAILS INTENDED FOR USE OF GAS TUNGSTEN ARC ROOT PASS WELDING OF NOMINAL WALL THICKNESS GREATER THAN 25 mm

5.2.2 It must be recognized that large diameter pipe and fittings with a relatively thin wall have a tendency to spring out of round after removal from the machining fixture. For this reason the measured diameters may vary with orientation and the tolerance of 0·25 mm shall apply to the average diameter.

5.3 *Dimension A* — Nominal outside diameter of component at welding end.

5.3.1 *Pipe* — According to IS : 1978-1982.

5.3.2 *Valves* — 125 mm and smaller $+ 2{\cdot}4$ $- 0{\cdot}8$

150 mm and larger $+ 4{\cdot}0$ $- 0{\cdot}8$

5.3.3 *Butt welding fittings* — 80 mm to 100 mm = $\pm 1{\cdot}6$

125 mm to 200 mm = $+ 2{\cdot}4$ $- 1{\cdot}6$

250 mm to 450 mm = $+ 4{\cdot}0$ $- 3{\cdot}0$

500 mm and above = $+ 6{\cdot}0$ $- 5{\cdot}0$

5.3.4 *Welding neck flanges* — As per valve, that is, 5 : 3 : 2

5.3.5 *All other components* — As specified in applicable Indian standard specification.

5.4 *Wall Thickness*

5.4.1 *All components* — Maximum *t* max — The maximum thickness at the end of component is—

a) Greater of *t* min + 4 mm or 1·15 *t* min when ordered on a minimum wall basis, and

b) Greater of *t* min + 4 mm or 1·10 *t* nominal when ordered on nominal wall basis.

Minimum *t* (min) = As specified in applicable Indian standard specification.

TABLE 1 DIMENSIONS OF WELDING ENDS

(*Clause* 4.5)

All dimensions in millimetres.

Nominal Pipe Size	OD at Welding Ends A		B	C	t
	Wrought or Fabricated Components	Cast Steel Valves			
65	73	75	63	63	5
			59	59·7	7
			54	55·3	9·5
			45	47·5	14
80	89	91	78	78·3	5·5
			74	74·5	7·6
			67	68·4	11
			58	61·2	15
100	114	117	102	103	6
			97	98	8·5
			92	94	11
			87	89·7	13·5
			80	83·3	17
125	141	144	128	129	6·5
			122	123·6	9·5
			116	118	13
			110	112·5	16
			103	107	19
150	168	172	154	154·8	7
			146	148	11
			140	142·3	14
			132	135·3	18
			124	129	22
200	219	223	203	203·7	8
			198	200	10
			194	196	13
			189	192	15
			183	186	18
			178	182	21
			175	179	22
			173	178	23
250	273	278	255	255·8	9
			248	250	13
			243	246	15
			237	240	18
			230	239	22
			222	228	25
			216	222	28
300	324	329	305	306	9·5
			303	305	10
			298	301	13
			295	298	14
			289	292	18
			281	285	22
			273	278	25
			267	273	28
			257	264	33

(*Continued*)

TABLE 1 DIMENSIONS OF WELDING ENDS — *Contd*

Nominal Pipe Size	OD at Welding Ends A		B	C	t
	Wrought or Fabricated Components	Cast Steel Valves			
350	356	362	337	338	9·5
			333	335	11
			330	332	13
			325	328	15
			318	321	19
			308	313	24
			300	306	28
			295	299	32
			284	292	36
400	406	413	387	389	9·5
			381	383	13
			373	376	17
			364	368	22
			354	360	26
			344	351	31
			333	341	37
			325	334	40
450	457	464	438	340	9·5
			432	434	13
			429	431	14
			419	423	19
			410	414	24
			398	405	29
			387	395	35
			378	387	40
			367	377	45
500	508	516	489	490	9·5
			483	485	13
			478	481	15
			467	471	21
			456	461	26
			443	450	32
			432	440	38
			419	429	45
			408	420	50
600	610	619	591	592	9·5
			584	586	13
			581	584	14
			575	578	18
			560	565	25
			548	554	31
			532	541	39
			518	528	46
			505	517	52
			491	504	60

Note 1 — Dimensions are in millimeters.

Note 2 — For tolerances *see* section 5.

Note 3 — The diameters 'B' is not mandatory.

EXPLANATORY NOTE

In the preparation of this standard assistance has been derived from ANSI 16.25-1979 'Butt Welding Ends', issued by the American National Standards Institute.

Printed at Delhi Printers, New Delhi, India